Windows

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Windows

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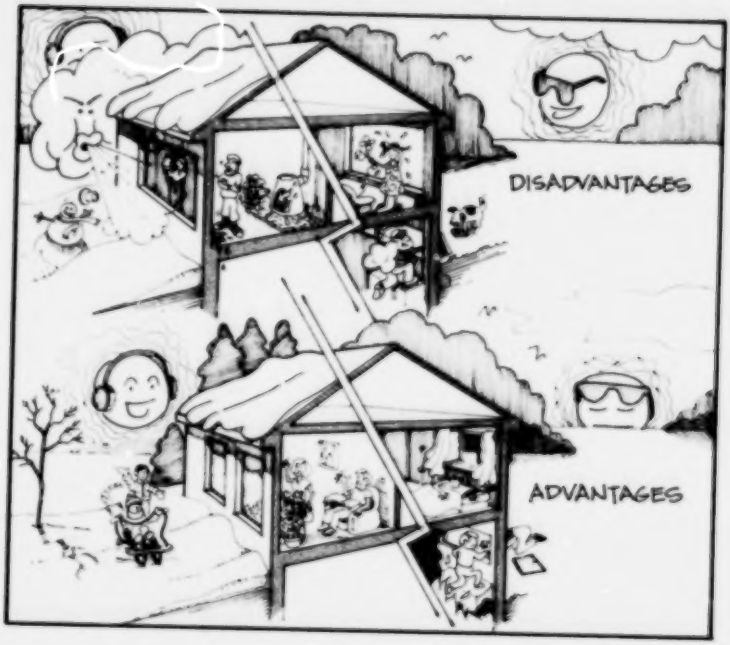

DISADVANTAGES
ADVANTAGES

Introduction

Windows are an essential part of every home. They give a house character and bring a home alive by providing daylight and a view. They admit warm sunshine in winter and cool breezes in summer. Yet, for all their benefits, windows are a weak spot in the exterior shell of your home. They are a source of drafts and can become covered with condensation and ice on cold winter days. If improperly sized and positioned, windows may cause overheating and poor ventilation.

Poor window performance can also significantly increase space heating costs. As the price of energy continues to rise, homeowners are becoming increasingly aware of the dollars spent to maintain comfortable indoor temperatures. Natural gas space heating costs for an average-sized bungalow in central Alberta have risen to about $400 per year. Window heat loss can account for $40 to $100 of this.

Since window performance affects both indoor comfort and the cost of home heating, careful consideration must be given to window design and selection when planning a new home or renovating an existing one. **This booklet will help you understand how windows work and how to make them work better.** It will provide useful guidelines for assessing the windows of your own home and for making rational decisions about upgrading an existing window or selecting a new one.

Window Terminology

A number of window terms will be referred to throughout this booklet (Figure 1).

Frame — part of the window consisting of the bottom sill, the side jambs and the top header jamb.

Glazing — clear part of the window that we look through. Glass is a glazing, as are the rigid and flexible plastics commonly used for interior storm windows.

Rough Opening — opening in the wall into which a window is placed. The rough opening width is the horizontal distance between the house framing studs on either side of the window. The rough opening height is the vertical distance between the lintel above and the framing supporting the window below.

Sash — framework which holds a pane of glass.

Sealed Unit — factory-assembled unit composed of two or more layers of glazing sealed around the edges to make it airtight. It is also referred to as **insulating glass or thermo-pane unit.**

Storm Window — layer of glazing added to the interior or exterior of an existing window.

Various styles of windows are now available. Table 1 compares five common types: awning, casement, double hung, fixed and slider.

Three other window styles that you may consider for special purposes are:

- **Bay or Bow** — This is a style formed by a series of windows extending out from the wall. The bay window usually has three sections; the bow has five. Set at various angles, the bay or bow window can take full advantage of light, ventilation and views. By alternating the location of casement and fixed windows in the unit, all windows can be cleaned from the inside. Bay and bow windows are difficult to install and must be properly air sealed and insulated, especially in the floor overhang.

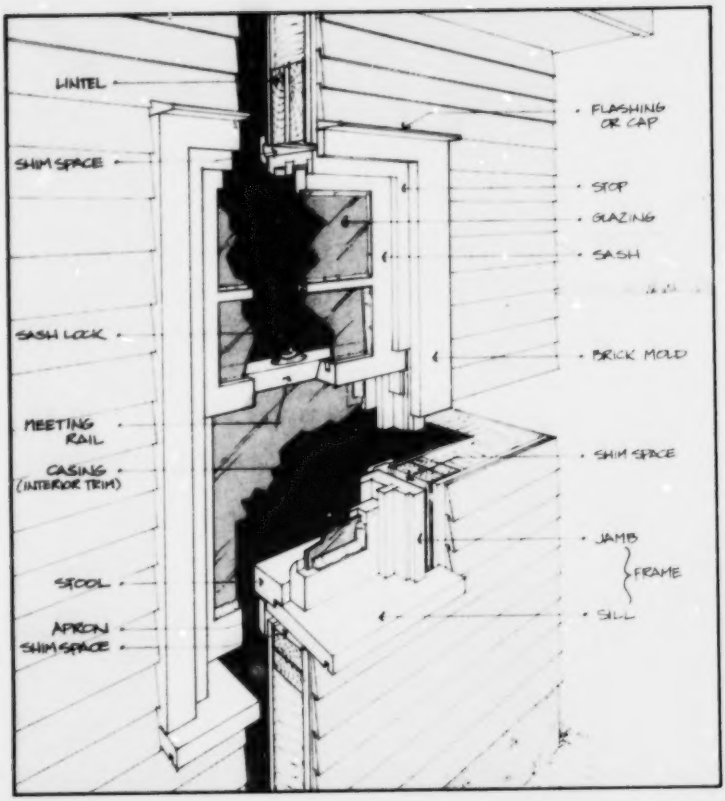
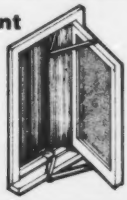
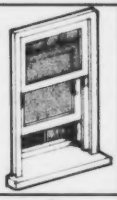
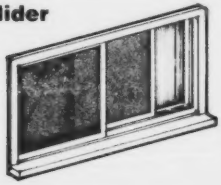

LINTEL
SHIM SPACE
SASH LOCK
MEETING RAIL
CASING (INTERIOR TRIM)
STOOL
APRON
SHIM SPACE
FLASHING OR CAP
STOP
GLAZING
SASH
BRICK MOLD
SHIM SPACE
JAMB
FRAME
SILL

Figure 1

Table 1
Comparison of Common Window Styles

Window Style	Comments
Awning	• Provides rain protection when open • Easy to clean inner and outer panes from inside the house • Combines with a fixed unit for a more energy-efficient window • Provides up to 100% ventilation through window area, but will not readily catch a breeze • Poor emergency exit when used in basement
Casement 	• Generally least air leakage of windows that open • Easy to clean inner and outer panes from inside the house • Provides up to 100% ventilation through window area • Size of window limited by strength of hardware • Generally most expensive • Can be damaged if open in high winds
Double Hung 	• Most common in older homes • Provides ventilation through 50% of window area • Generally high air leakage and frequent weatherstripping maintenance • No built-in screen • Can be difficult to clean especially with small panes • Meeting rail between sashes can obstruct view
Fixed	• Least air leakage • Accommodates large glass areas • No hardware or mechanism to fail • Provides maximum light and view • Most secure against forced entry but no emergency exit • No ventilation • Outer pane must be cleaned from outside
Slider 	• Includes horizontal and vertical units • Horizontal units allow ventilation and rain protection simultaneously • Easy to clean from inside if sashes removable • Normally least expensive of operable windows • Provides ventilation through 50% of window area • Requires frequent weatherstripping maintenance • Generally least secure against forced entry

- **Patio Doors** — These are large horizontal sliders; therefore, measures to reduce window heat loss can also be applied to patio doors. Choose units that seal tightly when closed. You may also consider french doors, which are a good energy-efficient substitute for sliding units.

- **Skylights** — These provide additional light and ventilation while maintaining privacy and wall space. They can have leakage and condensation problems, however, and must be carefully chosen and installed.

How Heat Moves Through Windows

Before you attempt to improve the windows in your home, it is useful to understand the way heat is transferred between indoor and outdoor environments. **Heat transfer takes place when a temperature difference exists,** and occurs through conduction, convection, radiation and air leakage.

Conduction

Anyone who has grabbed the handle of a metal frying pan left on an open campfire has painfully experienced heat transfer by conduction. Although heat transfer can be very rapid, the **ability of different materials to conduct heat varies greatly.** It is important, therefore, that windows are constructed with materials with low conduction rates.

The major paths for heat conduction through a window are the sash, the frame and the glazing (Figure 2). Choosing materials with low conduction rates for the frame and sash will minimize heat loss through this part of the window. Heat loss through the glazing is primarily affected by air, which is a poor conductor of heat. Conduction is slowed by layers of still air (called air films) along the inner and outer surfaces of each glazing and by the air trapped between individual panes.

Materials that are **poor conductors** of heat are said to have a **high resistance** to heat flow. This thermal resistance is described by the metric RSI-value (imperial R-value). Materials with higher R-values are better insulators.

Convection

Convection is the movement of heat in liquids and gases due to a temperature difference. Although air is a poor conductor it readily convects heat because warm air is light and tends to rise while cold air is heavy and tends to sink. As shown in Figure 2, convective heat loss from the window occurs in the following ways:

- Cold winter winds take heat away from the window surface by convection. These winds can also reduce the window's overall thermal resistance (R-value) by removing a large portion of the outside air film.

- Natural convection results in the formation of air currents inside the house as warm air next to a window surface is cooled and sinks to the floor.

- Convection also occurs in the air space between glazings as the warm inner pane loses heat to the cold outer pane. Convection increases with spaces larger than 19 mm (¾ inch).

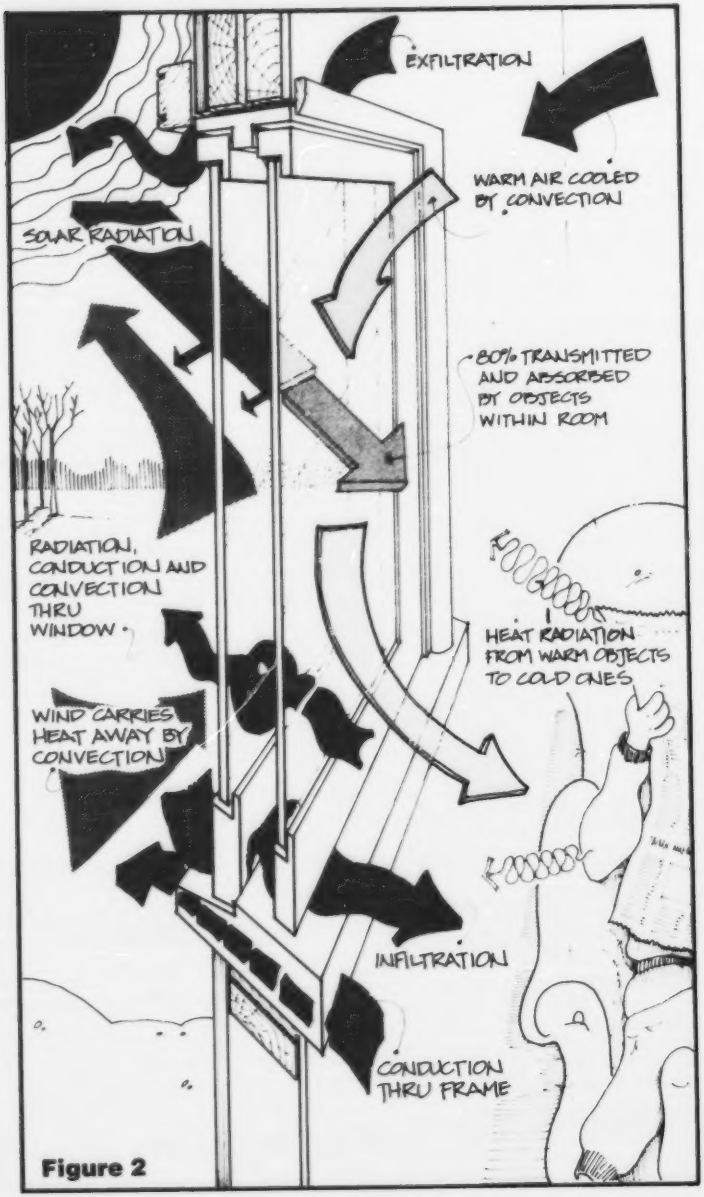

EXFILTRATION
WARM AIR COOLED BY CONVECTION
SOLAR RADIATION
80% TRANSMITTED AND ABSORBED BY OBJECTS WITHIN ROOM
RADIATION, CONDUCTION AND CONVECTION THRU WINDOW
HEAT RADIATION FROM WARM OBJECTS TO COLD ONES
WIND CARRIES HEAT AWAY BY CONVECTION
INFILTRATION
CONDUCTION THRU FRAME

Figure 2

Radiation

Sitting in front of a campfire or fireplace, you will be warmed by radiant energy transferred from the fire. The sun also radiates energy (solar gain) in the form of visible light, shortwave infra-red radiation and, in smaller amounts, ultraviolet radiation. The amount of radiation transmitted to the house interior depends on the number of layers of glass. For each additional layer, solar gain is reduced by about 10 per cent (Figure 2).

In a house, most transmitted solar energy is absorbed by room surfaces and re-radiated as longwave infra-red radiation. The part that is re-radiated back to the window surface is absorbed almost entirely by the glass. Some of the absorbed heat will be transferred to the outer glazings, and eventually outdoors, by conduction, convection and radiation. Most of it, however, will be trapped indoors creating a "greenhouse effect". If a room has a lot of glazing, the greenhouse effect can result in overheating, even in the winter.

Air Leakage

Uncomfortable drafts in winter are caused not only by convection currents, but also by cold air leaking into the house (infiltration) as warm air leaks out (exfiltration) as shown in Figure 2. This leakage is caused by a pressure difference between the inside of the house and the outdoors. This difference can be created by winds or by household appliances that exhaust indoor air to the outside, such as furnaces or clothes dryers.

Air leakage occurs through ill-fitting, poorly weatherstripped and improperly installed windows (Figure 3). It can be detected by using a "draft indicator" such as the smoke column from a lighted cigarette or smouldering cotton string.

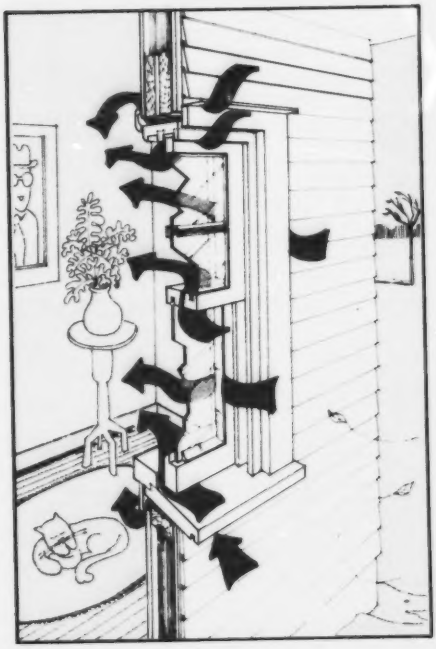


Figure 3

Assessing Your Windows

The first step in improving your windows is to assess their performance and identify any problems. Table 2 lists some common problems and suggests possible causes and solutions.

Table 2
Window Problems, Causes and Solutions

Indication	Possible Causes
Water puddling on sill	• Sill does not slope away from window
Water runoff towards house on underside of sill	• Underside of sill is flat
Blistering, cracking, flaking and peeling paint	• Water penetration and moisture saturation
Warping and rotting wood windows	• Moisture penetration of window parts due to deterioration of paint
Cracked, loose or missing glazing or glazing putty	• Putty has dried and weathered with age
Drafts	• Infiltration through and around window • Cold glass temperatures
Overheating	• Inadequate shading • Excessive glazing • Inadequate ventilation
Inadequate natural lighting	• Insufficient or poorly positioned glazing
Glare	• Too much glazing or unbalanced lighting
Condensation on inside surface of inner pane	• High indoor humidity combined with cold inner pane
Condensation between layers of glazing	• Air leakage into space between glazings • Broken seal
Condensation on frames of aluminum or steel windows	• Cold metal frame inside due to excessive heat loss
Condensation on specific windows only	• Refer to **Condensation Concerns** booklet for detailed description

Suggested Solutions
• Cut or build slope into existing sill
• Cut drip groove along underside to ensure proper runoff
• Determine moisture source and eliminate if possible • Clean, dry and repaint affected area
• Repair damaged parts of window and repaint • Cover with aluminum or vinyl cladding • Replace with maintenance-free windows
• Reputty or reglaze window as necessary
• Provide good air seal around glass, weatherstrip and caulk (see **Caulking and Weatherstripping** booklet) • Seal shim space between frame and rough opening • Reglaze existing sash with thermal unit • Install additional layers of glazing
• Install awnings, sun control films or tinted glazing • Eliminate or reduce window size • Replace window with unit that provides more ventilation • Install additional window or skylight
• Enlarge window opening • Install additional windows or skylight
• Reduce glazing area or balance lighting by installing a window on adjoining wall or skylight
• Reduce indoor humidity levels • Install additional layer of glazing • Reglaze existing sash with thermal unit
• Install additional layer of glazing • Ensure inner glazing tighter than outer • Install new thermal unit
• Reduce indoor humidity • Replace windows with units that have a thermal break
• Refer to **Condensation Concerns** booklet for detailed description

Choosing a Plan of Action

Once window problems are identified, you can decide on methods to solve them. Options ranked here in order of increasing cost and effort are:

- repair deteriorated windows
- caulk and weatherstrip
- install additional glazing layers such as storm windows or reglaze with thermal units
- install sun control devices such as solar films, awnings or tinted glass
- replace and modify existing windows

Repair Deteriorated Windows

It is usually less expensive and more convenient to repair existing windows than to replace them with new units. Water damage causes most window deterioration, especially in wood windows. Therefore, before repairing windows, identify and eliminate any sources of moisture penetration. Examine the sill. It should slope away from the window, allowing water to drain off. If the bottom of the sill is flat, a drip groove may have to be cut to ensure proper runoff (Figure 4).

Examine the window for paint cracks and chips and check the wood for deterioration. If decay is not extensive, the area can be dried, treated with a fungicide and repaired with putty. If deterioration is more serious, it may be possible to save the window by using a fungicide to arrest the decay process and then cladding surfaces with a material such as aluminum.

To repaint windows, start by removing the sash. Repair, caulk and weatherstrip both the sash and frame. Caulk the joint between the jamb and the sill to reduce water penetration. Remove excess layers of paint that make windows difficult to operate and repair or replace faulty hardware.

Before you replace broken glazing or install new putty, remove the existing putty, the glazing points, the glass and the putty behind the

glass. Reglaze the window as shown in Figure 4. Lay a bead of putty along the rabbet to provide an air seal, press the pane of glass into place, insert glazing points to secure the glass and, finally, lay a bevelled layer of putty around the outside edge of the glass to seal against water penetration.

Repaint windows with a good quality acrylic latex or alkyd (oil base) that matches the type currently used on the window. Before painting new windows, be sure to apply a primer appropriate for the type of paint to be used.

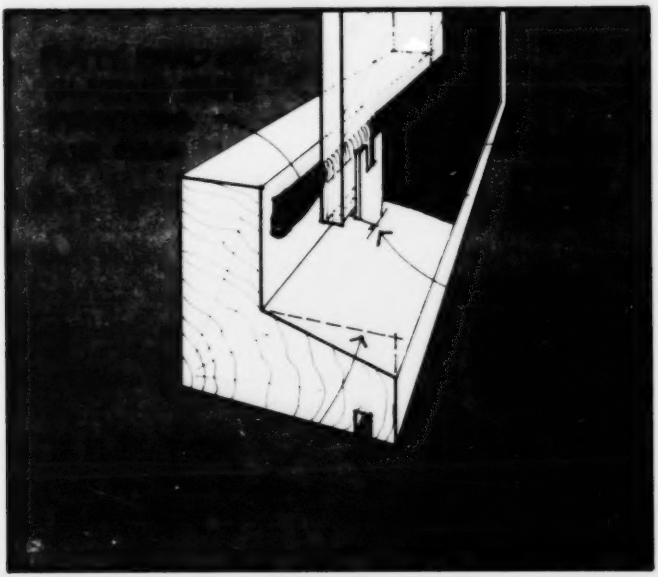


Figure 4

Caulk and Weatherstrip

Air sealing the windows in your home can be inexpensive and easily done. The different uses of air sealing products for windows are described in another booket in this series, **Caulking and Weatherstripping.** A number of points from that booklet are summarized as follows:

- For windows that have never been weatherstripped, a compressible weatherstripping such as tubular vinyl or closed cell

foam will provide a good, durable seal. Where possible, apply weatherstripping along the edge of the sash **as well as** along the jamb. Double weatherstripping in this manner will ensure an excellent seal on windows that open.

- Metal and vinyl sliders usually have factory-installed pile weatherstripping. If it is worn out, new weatherstripping can usually be slid into the existing channel. Replacement pile weatherstripping incorporating a vinyl strip is now available and will provide a better seal.

- For wide gaps, rope caulking or weatherstripping tape can be applied in the fall and removed in the spring.

- Consider applying a permanent seal with caulking to windows that are not required for ventilation. **Ensure these windows are not required for emergency exits.**

- Be sure the caulking is compatible with other materials you are using. Silicone, for example, cannot be painted.

- Install sash locks to seal the sash tightly against the weatherstripping.

Another common air leakage pathway is the shim space between the window frame and rough opening. Methods of sealing this area are shown in Figure 5.

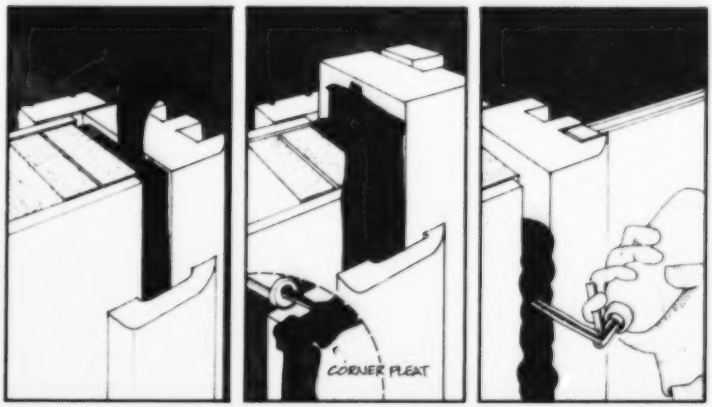


Figure 5

Polyurethrane foams are most easily applied in cracks greater than 12 mm (½ inch) and will provide a good seal with high thermal resistance. They do expand, however, and should be applied with caution or the window frame may warp. For smaller cracks, polystyrene cord and caulking is effective. The cord should have a diameter four times the crack width to ensure a good fit.

The polyskirt, also shown in Figure 5, can be used when installing a new window and will be discussed in more detail later in this booklet.

Install Storm Windows

Once windows have been repaired and sealed to reduce air leakage, you may wish to increase indoor comfort and reduce heat loss further by increasing their thermal resistance. Many people have added attic insulation to increase R-value and reduce heat loss through the ceiling. Similarly, conductive heat loss through a window can be reduced by increasing its R-value.

Adding a storm window is the most common way to reduce heat loss. It can be installed on the inside or outside of the existing window. An additional **air space of at least 12 mm (½ inch)** will decrease the heat loss from a single glazed window by approximately one-half. **Remember, most of the increased thermal resistance comes from the air space created, and not from the type of glazing material used.** Added benefits include reduction in condensation and icing due to the increased temperature of the inner glazing.

Properly installed, storm windows will also reduce air leakage. Although both permanent and storm windows should be well sealed, **it is extremely important that the inner layer of glazing is sealed tighter than the outer one.** This will prevent warm, moist air from leaking between glazings and condensing on the inner surface of the outer glazing.

Table 3 compares a number of common glazing materials. Glass is the most widely used and its optical and thermal properties form the basis for judging others. But if you require a glazing that is stronger, lighter, cheaper or easier to cut than glass, a plastic may better suit your needs. Your choice should be based on cost and functional aspects since **thermal performance does not vary significantly.**

Table 3
Common Glazing Types

Glazing Type	1985 Cost per m^2 (sq. ft.) (approximate)
Glass 3 mm (⅛ in.) (rigid)	$22.00 - $32.00 ($2.00 - $3.00)
Polyethylene 0.150 mm (6 mil) (flexible film)	$0.45 - $0.65 ($0.04 - $0.06)
Vinyl 0.250 mm (10 mil) (flexible film)	$3.20 - $5.40 ($0.30 - $0.50)
Vinyl — UV treated[b] 0.250 mm (10 mil) (flexible film)	$11.00 - $15.00 ($1.00 - $1.40)
Acrylic 3 mm (⅛ in.) (rigid)	$16.00 - $22.00 ($1.50 - $2.00)
Polycarbonate 3 mm (⅛ in.) (rigid)	$48.00 - $54.00 ($4.50 - $5.00)

Advantages	Disadvantages
• Readily available • Excellent transparency • Excellent durability • Non-combustible, chemically inert • Scratch resistant • Low IR transmittance[a] • Low thermal expansion contraction	• Heavy • Low impact resistance • Breakage creates safety hazard • Careful installation required
• Readily available • Lightweight • Easy to cut	• Short service life • Easily damaged • Poor visual appearance • High IR transmittance • Flammable
• Lightweight • Easy to cut • High solar transmittance • Stronger than polyethylene	• Limited availability • Becomes brittle with age • Hard to eliminate wrinkles • Some visual distortion • High IR transmittance • Flammable
• Resistance to UV degradation • Does not become brittle	• Similar to untreated vinyl except for resistance to brittleness
• Readily available • Lightweight • Good durability • Moderate impact resistance • Fairly easy to cut • Low IR transmittance	• Incompatible with butyl tapes and sealants • Susceptible to scratches • Softens under moderate heat • High thermal expansion contraction • Flammable
• High impact resistance • Lightweight • Good transparency • Good durability • Low IR transmittance • Available with scratch resistant surface	• Limited distribution • High thermal expansion contraction • Flammable

[a]Does not readily transmit infra-red radiation.

[b]Exposure to ultraviolet radiation can break down some plastics over time.

There are a number of systems available for attaching these glazing materials to the window. The more common ones are shown in Figure 6.

- **Weatherstripped Acrylic and Retainer Clips** — This is an inexpensive method of applying rigid plastic. It is important to use a good quality closed-cell foam weatherstripping to ensure a tight seal between the casing and plastic. Note that the glazing cannot be removed quickly in case of an emergency.

- **Magnetic Seal and Rigid Acrylic** — Although more expensive, this method of installing rigid plastic ensures a good air seal. The high thermal expansion and contraction rates of plastic may cause the magnetic seal to slide and the acrylic glazing to fall. It may be advisable to install a few retainer clips in case this happens. This will, of course, make the glazing more difficult to remove in an emergency.

- **Heat Shrink Film and Double-Sided Tape** — This is the least expensive system and provides an excellent seal. Once the film is in place, heating it with a hair dryer draws it tightly across the window opening. The system is generally not reusable and removing the tape often removes paint as well.

- **Film with Spline and Channel** — When using this system with a flexible plastic, install it beside the casing where it will be less noticeable. It requires two people to draw the film tightly over the window opening. The system provides an excellent seal and the film can be reused.

An interior application is preferable to reduce air leakage and increase durability. A tight seal to the inside will greatly reduce the likelihood of condensation between glazing layers. However, if a room requires ventilation or an emergency exit, be sure interior storms can be easily removed.

Exterior storm windows of wood or metal can also be installed; however, this is an expensive alternative. A variety of types of units are available, including permanent or removable units. Their primary function should be to improve the thermal resistance of windows and not to stop air leakage. **The principle air seal should still be provided by the inside window.**

When choosing an exterior storm, consider ventilation requirements, the need for emergency exits, maintenance of the units and their general appearance on the home.

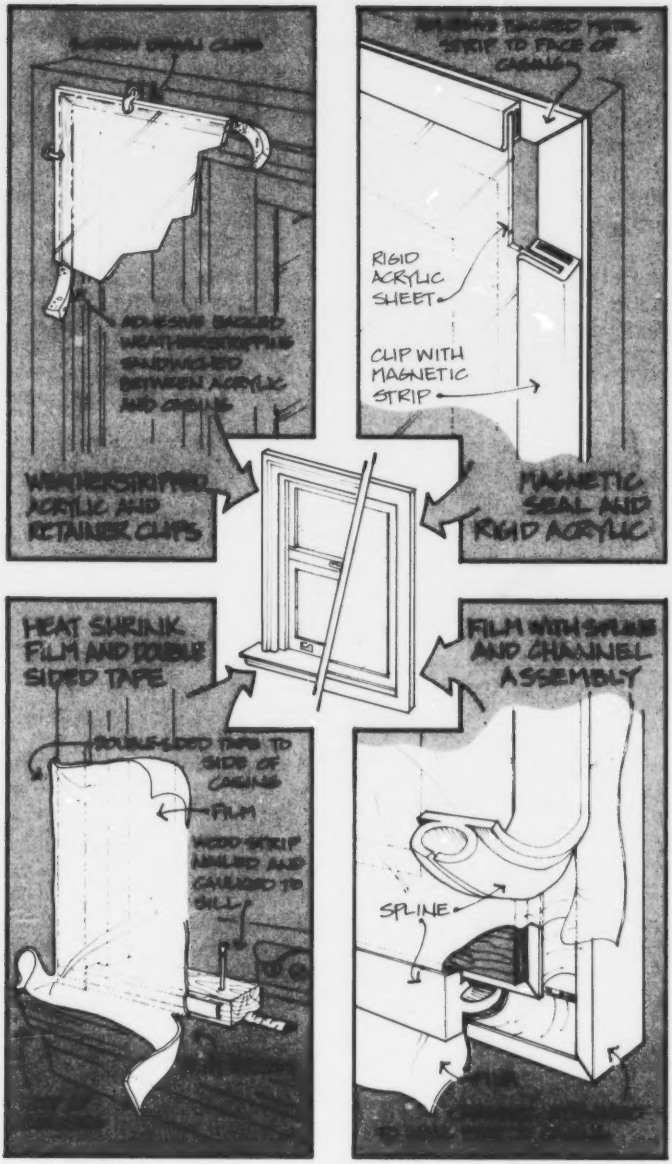

RIGID ACRYLIC SHEET
CLIP WITH MAGNETIC STRIP
WEATHERSTRIPPED ACRYLIC AND RETAINER CLIPS
MAGNETIC SEAL AND RIGID ACRYLIC
HEAT SHRINK FILM AND DOUBLE SIDED TAPE
FILM
SPLINE
FILM WITH SPLINE AND CHANNEL ASSEMBLY

Figure 6

Upgrade Window Glazing

Another method of increasing thermal resistance is to replace the existing glazing with sealed multi-glazed units. Whether or not this can be done will depend on the design, material and condition of the existing sash and frame. For example, if the window cannot accommodate a sealed unit with an air space of at least 12 mm (½ inch) between glazings, it may be more efficient and less expensive to install a storm window.

Consider hiring a qualified contractor since improper installation will void the manufacturer's warranty. If you decide to do the conversion yourself, obtain installation information from your glass supplier. Proper allowances must be provided for expansion.

Methods of Sun Control

Rooms with large window areas oriented east, south or west can receive excessive amounts of solar radiation. This results in overheating, glare and fading of furnishings.

Drapes and blinds are commonly used to block incoming sunshine, but they also obscure vision and reduce indoor lighting. It is preferable to stop sunlight before it passes through the window. Outdoor shading with trees, overhangs, awnings or shutters may provide adequate sun control. Indoor "solar films" applied directly to the inside face of the glass provide an alternative solution.

Solar films block out sunlight. They are available in a variety of colors, each with a different sun-screening capability. Solar films also reduce the ability of glass to emit radiant energy absorbed by the glass. This causes the glass to heat up and expand. If the appropriate films are not applied, larger windows may expand too much and crack. If this occurs with sealed units, the manufacturer's warranty will be void. For this reason, the application of solar films is best handled by an experienced contractor.

Solar films should be considered a permanent application because, once installed, they are not easily removed. They do scratch, however, and care must be taken when cleaning the window.

An alternative to solar films is to install tinted glass. This is an expensive option; however, it will avoid the problems of solar films.

Replace Existing Windows

If none of the previous methods adequately solves your particular window concerns, the only alternative may be to replace your windows.

If you own an older home, window sizes may no longer be standard. But don't despair! This is not a major renovation. Many manufacturers now provide custom-fit windows, factory-built to your specifications.

Replacement units can even be made to fit inside existing window frames (Figure 7). If you are handy and decide to do the work yourself, proper installation is extremely important to ensure good window performance.

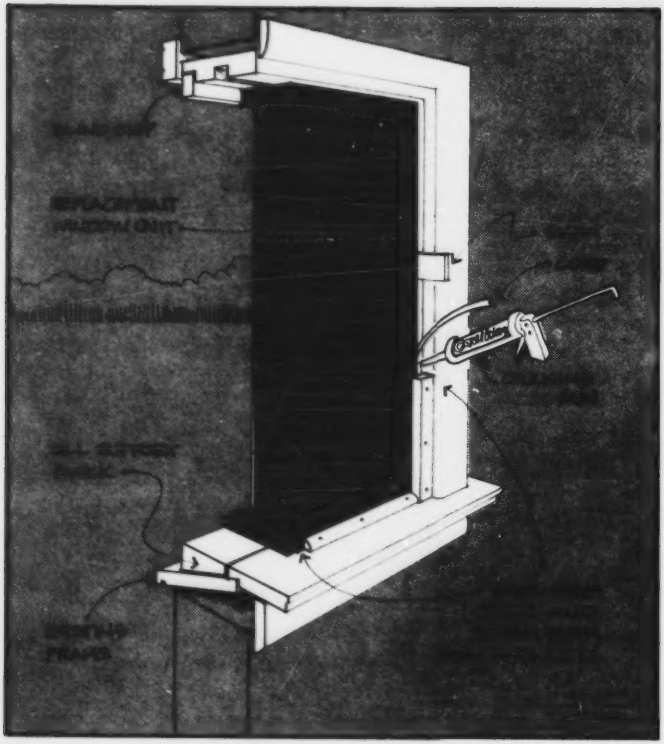


Figure 7

To operate properly, the window must be installed plumb, level and square (Figure 8). Ensure flashings are installed and the frame is adequately supported. The shim space between the frame and rough opening must be insulated and sealed to minimize heat loss and air leakage. Any one of the methods illustrated in Figure 5 will provide a good air seal. If you are using the polyskirt method, follow these steps:

- Cut a single strip of 0.150 mm (6 mil) polyethylene which is wide enough to fold back onto the inside wall and long enough to allow for pleats at each corner (Figure 5).
- Lay a bead of caulking on the outside of the window to ensure that joints in the frame are inside the polyethylene seal.
- As you apply the polyethylene strip, staple it to the window through the bead of caulking. Pleat it at the corners as shown in Figure 5 so that it can easily be folded back onto the wall.
- Inject sealant into each pleat.
- In the rough opening, place shims between the rough opening and the polyethylene to avoid puncturing the seal.
- Lightly pack the shim space with batt insulation.
- Lay a bead of caulking along the wall where the trim will go and then fold back and staple the polyethylene.
- The polyethylene can be trimmed and the interior trim replaced.

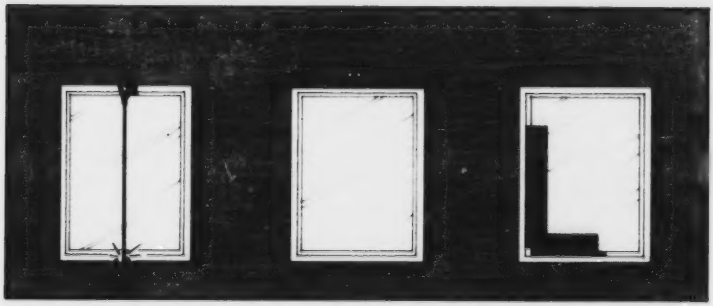


Figure 8

If windows must be replaced, it is a good opportunity to consider enlarging a window opening, eliminating a window or creating a new opening elsewhere. This usually involves a major renovation, but it may be the only solution to problems of inadequate ventilation, overheating, poor lighting or glare.

Selecting a New Window

As energy costs have risen and construction techniques improved, demands have been placed upon window manufacturers to produce well-designed, long-lasting windows that require little maintenance.

This section will help you select an energy-efficient window that will:

- minimize heat loss from the house
- prevent cold winter drafts
- minimize condensation and frost
- allow in a maximum amount of light without overheating or glare
- provide adequate ventilation

Before shopping for a new window, review Table 1 and decide on the style of window you want. Figure 9 shows many of the window features you should be considering. Choose a window that incorporates as many of these features as possible. Information can also be obtained from the Canada Mortgage and Housing Corporation (CMHC) window evaluation reports. These are available from the window manufacturer or your local CMHC office and include information on air leakage test results and installation methods. Determine your color and maintenance rquirements. Measure the rough opening of the windows you are replacing and write the measurements down as width times height.

The features shown in Figure 9 can be found in windows constructed of wood, metal, fibreglass and a plastic called polyvinyl chloride (PVC). Wood is the best natural insulator. It is difficult to maintain, however, and unless clad with aluminum or vinyl will have to be painted every four or five years. A window can be clad completely or weather-protected on the outside to retain a natural wood finish on the inside.

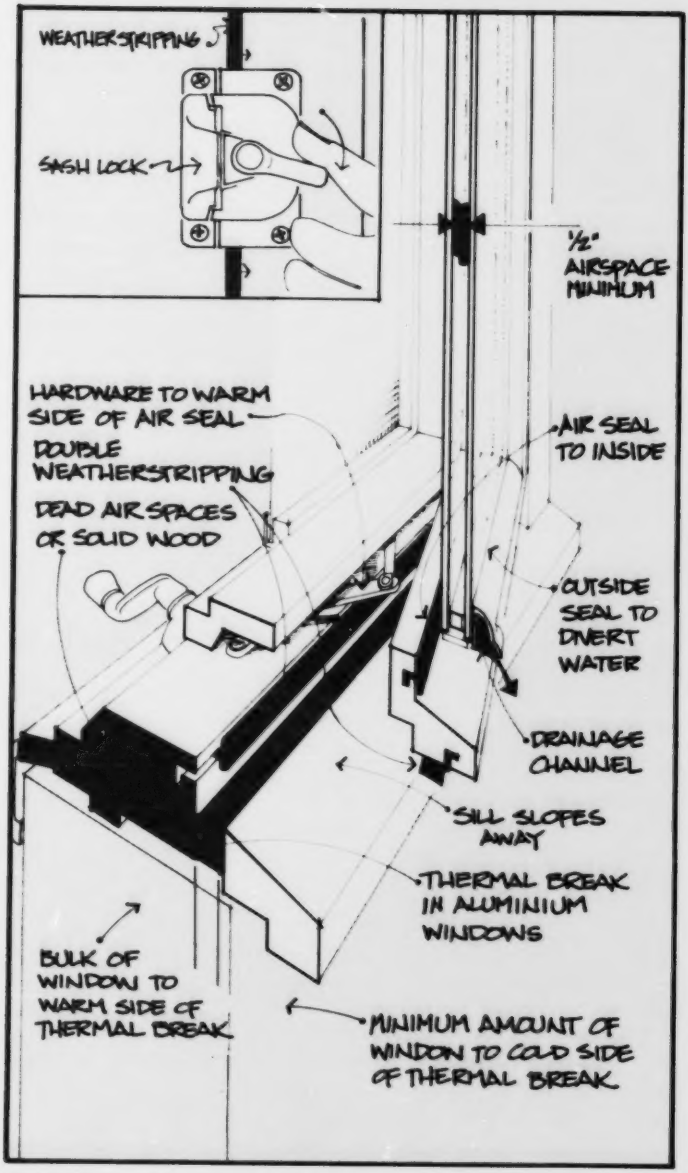

WEATHERSTRIPPING
SASH LOCK
½" AIRSPACE MINIMUM
HARDWARE TO WARM SIDE OF AIR SEAL
DOUBLE WEATHERSTRIPPING
DEAD AIR SPACES OR SOLID WOOD
AIR SEAL TO INSIDE
OUTSIDE SEAL TO DIVERT WATER
DRAINAGE CHANNEL
SILL SLOPES AWAY
THERMAL BREAK IN ALUMINIUM WINDOWS
BULK OF WINDOW TO WARM SIDE OF THERMAL BREAK
MINIMUM AMOUNT OF WINDOW TO COLD SIDE OF THERMAL BREAK

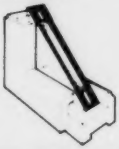
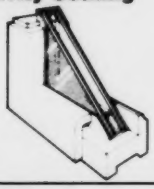
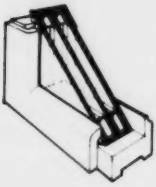
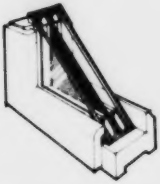
Figure 9

Metal windows, on the other hand, are poor insulators and require a thermal break such as plastic or rubber (Figure 9). This will slow down the movement of heat to the outside of the window and help prevent condensation on the sash and frame. Metal windows are usually coated with a baked-on enamel which requires little maintenance.

Vinyl and fibreglass windows, like wood, are poor conductors of heat and do not require a thermal break. They are virtually maintenance-free and impact and scratch resistant. One limitation is the small number of colors available. Fibreglass windows have recently been introduced to the Alberta market and distribution is limited.

Finally, to assist you in choosing a sealed multiglazed unit, Table 4 presents a comparison of products now available.

Table 4
Selecting a Window Glazing

Glazing Type	Comments
Double Glazed 	• Least expensive • Readily available • RSI 0.36 (R 2.0) with a 12 mm (½ in.) air space • About one-half the heat loss of single glazed • No condensation down to − 15 C with 30% indoor humidity levels
Double Glazed with Low Emissivity Coating 	• Commonly referred to as "low e" glass • Adds 10%-30% to window costs of average double glazed home • Recently introduced so availability limited • Same thermal and condensation characteristics as triple glazed • Admits approximately same amount of light as triple glazed • Advantages of triple glazed without the bulk and weight • Not visible
Triple Glazed (all glass) 	• Adds 10%-20% to window costs of average double glazed home • Readily available • RSI 0.57 (R 3.2) with a 12 mm (½ in.) air space • Heat loss reduced by about one-third over double glazed • No condensation down to − 40 C with 30% indoor humidity levels • Lets in about 10% less light than double glazed • Reduces outdoor noise • Bulkier than double glazed • Extra weight can strain hardware designed for double glazed unit • On a net basis, more energy efficient than double pane in all orientations, including south
Triple Glazed (2 glass, 1 suspended film) 	• Adds 15%-25% to window costs of average double glazed home • Limited availability • Two types of film available • Type 1 — RSI-value similar to triple glazed — maximizes visible light and solar gain but less effective in reflecting thermal radiation • Type 2 — RSI 0.76 (R 4.3) with a 12 mm (½ in.) air space — less efficient in transmitting visible light but reduces winter losses and summer gains by reflecting thermal radiation • Bulk of triple glazed but weight of double glazed • Not visible